The Traffic Problems of Interurban Electric Railroads

A THESIS

Presented to the Faculty of the Graduate School of the University of Pennsylvania in Partial Fulfilment of the Requirements for the Degree of Doctor of Philosophy

BY

THOMAS CONWAY, JR.

UNIVERSITY OF PENNSYLVANIA

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By Thomas Conway, Jr.

The application of electricity as a method of propulsion has been one of the most notable achievements of our generation. The substitution of the trolley car for the horse car has revolutionized city life, led to the enormous development of our suburban districts and entirely changed the possibilities of country living. There is no class of people who have not profited by the change. The new power has revolutionized the street railway industry. The changes which it made in urban street railway transportation are generally known. These roads, however, were affected less than any other class of lines. Electric power brought into being an entirely new transportation agency. The interurban road was unknown twenty years ago. In the last two decades there has sprung up a great network of these lines, literally grid-ironing the country, and each year sees more rapid construction than that of any preceding period. The economic basis of these roads is a matter about which the public knows practically nothing. Their traffic problems are either misunderstood or entirely unfamiliar to even well-informed men. The attention of interurban railway officials at the present time is chiefly centered upon the solution of these questions if the character of topics discussed at their conventions furnishes an accurate criterion. The importance of the interurban railway industry, the widespread and intimate effect which it exerts upon the people of our country and the growing importance of its securities as investments warrant a careful analysis of the traffic problems of these roads.

Electric railways can be grouped into four main classes—the urban, suburban and interurban systems, and the electrified divisions of steam railroads.

The first, and the type earliest established, is the street car line originally operated by horse power, and now by electricity and located in cities and large towns. The system almost always lies within the city limits, and is generally circumscribed by the thickly settled districts. The cars are run at low speeds, making stops at every street intersection.

The second group is made up of suburban lines radiating from the cities through the outlying residential districts. These lines either interchange traffic with the urban companies at their terminals or operate their cars over the city tracks. The first method is generally followed in the large eastern cities because of the diversity of ownership of city and suburban lines, and also because of the difficulty of handling the much larger and longer geared suburban cars upon the narrow and congested city streets. The second largely prevails in the West. These suburban lines are in no sense interurban roads, although they are frequently classed as such. They are rapidly assuming the form of railways whose characteristics are drawn both from the city railways and the interurban lines. These roads are in the first instance almost always located on the public highways. Their speed of operation is usually restricted by the demands of safety, enforced not only by the fear of damage claims, but by municipal and borough regulations. They are also required to take on passengers at frequent intervals. Owing to these limiting conditions, suburban lines must be content to run at slow speeds and to comply even in sparsely settled sections, in a large measure, with the standards of operation prevailing upon city streets. Suburban lines are usually built to serve outlying communities which have already been built up by the steam railroads. They offer a local service supplementing the steam lines. Their area of action is very limited both because of their slow speeds, which require much time to travel a short distance, and owing to the additional handicaps under which they labor in competition with the steam lines because of the supplementary journey which the passenger must make on the city cars to reach the business district. The largest number of these suburban lines are to be found around the large cities in the East.

The interurban electric railway is entirely different from any of the classes of lines already described. It is, as its name implies, a railroad operated by electric power connecting large towns or cities and usually operating in competition with the steam railroads. It is primarily a passenger railway reaching to a large extent localities which the steam railroads do not serve, closely following the movements of population, as the steam railroads cannot follow them, picking up traffic at the various points in the town which it traverses and through the country at short

intervals along the line, and offering a service whose frequency and economy the steam roads cannot equal. It differs from the suburban line in that it must secure traffic by offering a faster service, which necessitates a different type of construction and equipment.

The fourth class of electric railroads consists of the electrified divisions of the steam railroads. These compete for the suburban business, and it is likely that as time progresses a number of sections now covered by interurban lines will also be served by electrically operated trains running on tracks at present used by the locomotive.

The business of the interurban railway can be divided into three main classes; the handling of passenger, freight and miscellaneous business. The last includes mail and express and income arising from electric light supplied by these companies. Judged from the standpoint of earnings, the passenger business makes up almost the entire income of the electric lines. In this the interurban differs radically from the steam roads. Upon the steam railroad systems the receipts from freight traffic comprise almost 70 per cent. of the gross earnings, while on the electric railroads the average receipts from freight are less than one-half of 1 per cent. Some idea of the comparative sources of income of the steam and electric railroads can be secured by comparing the data compiled by the Interstate Commerce Commission for the year ending June 30, 1902, with the Census report compiled by the Department of Commerce and Labor of the Bureau of Census as of the same date.

	Steam	Per. Cent of Total.		Electric	Per. Cent of Total.
Passenger.....	$351,356,265	22.12		$233,821,549	94.4
Mail.....	38,453,602	2.42		432,080	0.2
Express.....	31,121,613	1.96		401,672	0.2
Other Car Pass...	8,202,982	.52		303,608	0.1
Freight.....	1,122,608,471	70.67		1,038,097	0.4
Other Earnings..	36,729,104	2.31	Sale of Electric	7,703,574	.31
Miscellaneous....	54,000	.01	Current	3,853,420	1.6

The reasons why 95 per cent. of the income of the electric railroads in the United States is derived from the passenger business are partly historical and partly economic. In the first place, the major portion of the income of the electric railways is derived from the city lines on which it is not possible to maintain freight

service. The interurban roads have also been slow to realize the possibilities of any other business except the handling of passengers. The suburban and even the interurban lines have, for the most part, been constructed by men who had street railway training, which influenced them to pay exclusive attention to the passenger business. To judge of the relative proportions of the various classes of business of the interurbans by the census figures, which is the only reliable data available, gives an erroneous impression because of the overwhelming preponderance which the city lines exert in the calculation.

The passenger business of the interurban roads is mainly long distance travel and most of their earnings come from handling passengers between the terminal cities. The extent to which the intercity travel figures in the gross earnings can be judged by the investigations conducted by the Muncie, Hartford and Fort Wayne Railway. This company represents a distinct type of interurban. The tracks are laid from court house to court house in the terminal cities, three-fourths of the entire mileage lying adjacent to the Lake Erie and Western Railroad. In the cities cars are operated only one way, and the tracks of no other company are used. In the terminal city of Muncie but four minutes are required to run from the court house to the corporate limits, so that practically no city service is given. In the total traffic of the line during 1904 * the proportion of business furnished by the towns was 82.7 per cent. supplied by the rural districts, a ratio of nearly five to one. While this ratio may not be as pronounced in the case of other roads having a greater proportion of mileage in the cities, yet it is conceded that the success of the interurban depends upon its ability to develop and retain intercity business.

In the struggle for traffic with the railroads, the interurban possesses important advantages. These lines are essentially local affairs and for that reason are able to regard local necessities in their competition with the railroads. They depend not so much upon rates to get business from the steam lines as upon the superiority of their service.

Because of the greater economy of operation the interurban can offer facilities which are impractical for the steam road. On the electric railway the necessary power for the movement of large cars is taken from a wire or a third rail and is applied

*This data is the latest accurate authoritative statement which has been published It represents the results of a careful investigation.

directly to the axles of the cars. On the steam roads, the engine, representing with its tender an enormous weight, is required to generate enough power not only for its own propulsion, but to drag after it a train of cars. Several important consequences result from this difference between steam and electric traction. First, on the electric railway single cars may be used, taking their power as required under such headway as may be necessary to accommodate the traffic, while the steam engine must for the sake of economy be loaded somewhere near its capacity, so that the service is necessarily less frequent than that offered by the interurban. The steam service under exactly similar conditions is much slower because of the great amount of time required to start and stop the trains. A single electric car can be stopped in much less time than that required to halt an engine, tender and three cars of equal size, while in starting, the advantage is even greater, the power applied directly to the axle of every electric car, getting it in rapid motion before the steam engine has done more than start its load. The electric car can, therefore, cover a much greater distance in an hour than a passenger train making the same number of stops.

Another very important advantage possessed by the interurban is the ability to follow the traffic up hill and down hill, over grades which are unsurmountable to a steam railway, up which indeed a steam engine could not propel its own weight. A locomotive which for each 1,000 pounds of weight on the driving wheel, the standard by which its efficiency is measured, can pull a load of 25,000 pounds on the level, can only handle 6,708 pounds up a grade of 44.8 feet to the mile. When a 3 per cent. grade, or only 158 feet to the mile, is encountered, it is practically all that the steam engine can do to crawl, coughing and panting, to the summit. For the electric road, however, the height of the grade is merely a question of the amount of power to be taken from the wire, and equipment can be provided which will rush an interurban car, as heavy as the ordinary passenger coach, up a grade of 355 feet to the mile at a speed of 45 miles per hour. These are inherent advantages which give to the interurban a basis of permanency, and which enable it to succeed in competition with its powerful and well entrenched rival.

The degree to which the interurban can compete with the steam roads for the through passenger business depends almost

entirely upon the character of construction which has been followed. The type of construction is the most important factor in judging of the traffic possibilities of the system and a proper understanding of this problem is essential in studying the traffic of these roads.

The pioneers in the interurban field, drilled for the most part in urban systems, believed that the number of stops which the interurban can make was a matter of little consequence. Stops were granted with careless prodigality wherever traffic existed. Almost every farmer could secure one if he asked for it when negotiating with the promoters over the right-of-way. Emphasis was laid upon the ability of the interurban to stop at every man's door and pick up traffic at every road or lane. These early ideas have, however, been abandoned. Railway managers now understand that every increase in the number of car stops brings about an added power consumption, lengthens the running time between termini, and increases the cost of maintaining equipment. The cost of power required to increase the speed of a car to maintain a given schedule is a considerable item, and unless the traffic secured by making the stops is considerable, the road will lose money by so doing. The following table, prepared by E. E. Kimbell, of the Engineering Department of the General Electric Company, demonstrates very clearly that the interurban, offering a high speed service, must either keep down the number of stops to a minimum or be prepared to provide for a large increase in the power consumption.

Gross Weight in Tons	Interurban Cars Maximum speed	Stops per mile	Watt hrs. ton-mile
20	45 m. p. h.	0.50	80
		0.75	87
		1.00	92
40	45 m. p. h.	0.50	67
		0.75	76
		1.00	81
50	45 m. p. h.	0.50	67
		0.75	73
		1.00	78

We can therefore understand why it is that the interurban roads are at the present time unwilling to increase their number of stopping points except in the thickly settled districts. In the earlier days stops were made at frequent intervals, and this was one of the strongest arguments for the interburban. It is now

recognized, however, that the additional stops must be made "at the expense of the coal pile." The problem, therefore, of the electric line is exactly similar to that which is faced by the operating department of the steam railway. In order to maintain a high speed, the electric railway has been forced to come almost to the steam railway standards of locomotion, construction and equipment.

The first consideration in maintaining high speed service is the securing of a private right of way. The operation of cars weighing from 30 to 50 tons at speeds from 45 to 50 miles an hour upon a public road is foolhardy. No matter how level the road may be, the operation of cars at these speeds is extremely hazardous. With cars of this weight a long distance is required for stopping, and the electric line constructed in this manner is open to great risk of accidents because of the intersection of a number of highways. The position of the electric line is even more defenseless than that of the steam road, for while the latter has only to provide against accidents at the intersections with the public highways, the electric road must in addition exercise watchfulness at every farm crossing and private lane which is carried over the tracks the entire length of the road. The number of grade crossings is multiplied tenfold, bringing additional liability to accident. An electric road built in this manner is forced to accept one of two alternatives. It can either maintain the speed and settle for the numerous damage claims which it will be forced to meet, or it can reduce the speed of operation, thereby losing its grip upon the through business which constitutes its main source of support. Experience has shown that the second alternative is the one usually adopted, for it takes many thousands of riders to pay the cost of a single accident. In addition, accidents involving injury and loss of life arouse the local communities and induce the passage of restrictive legislation limiting the speed of cars and requiring them to stop at every road intersection. Under such conditions fast time is absolutely impossible. The construction of interurban roads upon public highways is most unfortunate. The service becomes constantly slower as the country settles up, with a consequent increase in the time required to travel from one end of the line to the other.

What the interurban road gains, therefore, by the growth in its local business it loses by the decrease in its through traffic,

which little by little drifts to the steam lines. This is strikingly shown by the experience of the Pennsylvania Railroad. With the construction of the electric lines between Philadelphia and Wilmington the Pennsylvania line connecting these two cities lost heavily; the traffic was so greatly diminished that the maintenance of many stations on the steam road was no longer profitable, and a number were abandoned. At almost every point, schedules had to be reduced because of the small volume of business. Mr. Samuel Rea, the third vice-president of the company, in testifying before the Royal Commission on London traffic in 1906 brought out the fact that this business had now come back to the steam line, because as he expressed it, the trolleys had induced building within the first few miles, which necessitated a large number of stops and a slower speed, constantly increasing the length of time required to reach a given section; the electric line became, therefore, so unattractive that the people naturally had to resort again to the steam railroad. Mr. Rea expresses the belief that the same thing would soon occur upon almost every other portion of the Pennsylvania system.

It is exceedingly difficult to properly maintain a rock ballasted "T" railed road on a public highway. Ditches can be provided only on one side of the road which is therefore only half drained. Every slight undulation in the highway must be conformed to by the electric line; continuous equalizing of grades being impossible because of the objection which the land owners offer to variations in the level of the electric line and the road. As a consequence of these objections, interurbans constructed upon the public highways are meeting with constantly increasing disfavor both by investors and engineers.

The second error into which the builders of the early interurbans fell was in the construction of lines with too heavy grades. The apparent ease with which the electric cars surmounted grades prohibitive for locomotives directed attention from the economies of low grade electric lines. For the pioneers in the interurban field, money was very difficult to secure and they were forced to husband it in every way possible. Every dollar saved on the cost of grading decreased so much the original cost of construction of the line, and these opportunities for economical construction were eagerly seized. It was believed to be good policy to spend

less money on excavations, and operate the road with heavier grades than to make large outlays in order to secure a comparatively level line.

The problem which the promoters of the interurban met with differed in no respect from that which presented itself to the builders of our steam railroads. The only difference was that the builders of the electric railway had a wider latitude than their predecessors because of the superiority of the electric motor over the locomotive as a hill climber. It was a long time until even interurban officials recognized that the same laws of physics and the same principles of construction and operation which had been worked out for the steam roads applied to them. This fact is not even yet understood by the investor and the general public.

The cost of moving each ton of burden over a grade varies but little, no matter what form of power is used. The same amount of energy is required in each case and the only economy which is possible is because power can be more economically generated in a large power house than in a locomotive boiler, and more effectively applied through the medium of the motor than through a steam engine directly connected to the driving wheels. The economies which the electric line enjoyed because of its ability to operate in single car units with almost the same efficiency as in trains was so great as to conceal and entirely offset the losses which arose from the heavy computation of power used up in surmounting excessive grades. Single cars are frequently fitted with motors having a horse power energy equal to that of the average locomotive designed to handle ten to twenty cars of equal weight. There is small wonder that grades seem of little consequence to the electric car so long as scrutiny is not directed towards the coal bill.

It has only been within recent years that the science of electric traction was well enough understood and worked out with sufficient definiteness to enable the engineer to demonstrate mathematically the economy—indeed, the necessity—of constructing roads with low gradients and easy curves.

The method by which the problem is determined is illustrated by the following computation made by Albert B. Herrick, of New York, a recognized expert on interurban railway matters:

In the matter of the effect of grades, assuming the case of a 1,000 foot grade of 3 per cent., as against a 5 per cent. grade, and taking the cost of

reducing the 5 per cent. grade to a 3 per cent. grade as $3,500, the relative value of the two can be computed as follows:

A car going up a 5 per cent. grade for 1,000 feet has gained an elevation of 50 feet, and, assuming the car weighs 25 tons, the car's potential energy at the top of the grade has increased 2,500,000 foot pounds. In order that the motors may produce this 72 horse power of energy, there will be required at the power station, under the very best average conditions of conversion and transmission, the capacity to deliver 144 horse power for the time that it takes the equipment to surmount this grade, assuming that the equipment is geared to 40 miles per hour on the level, and a schedule speed of 20 miles per hour, including stops and slow downs, is maintained. it would require 41 seconds to mount this grade, and during this time the station is exerting 144 horse power for this one car due to this grade alone.

Taking, on the other hand, the 3 per cent. grade for the same distance (but as a matter of fact reducing grades reduces the distance between terminal points, as a grade may be considered a curve in a vertical plane) when the car has mounted this grade, it has gained potential energy of 1,500,000 foot pounds, or 45 horse power, and the station has had to produce only 90 horse power for this car. The speed at which the car could ascend the 3 per cent. grade would be 21 miles per hour, and the time consumed would be 30 seconds. The time gained on the 3 per cent. grade compared with the 5 per cent. grade would be 11 seconds, and the horse power output at the station saved would be, by the lower grade, 54 horse power for 30 seconds and 144 horse power for 11 seconds each time a car mounted the grade. Assuming the cost of power at 1 cent per horse-power hour, the cost of power would be 88 cents. Assuming the cost of time at $4.60 per car hour, this would mean a saving of .0137 cent as representing the saving in car operation of the 3 per cent. grade as against the 5 per cent. grade. Assuming half-hour schedules at terminals and a symmetrical grade on each side, there would be a saving of $2.08 per day, or a return of 21.6 per cent on the $3,500 expenditure necessary to produce the grade from 5 per cent. to 3 per cent. This grade could be reduced still further with economy, but 3 per cent. was taken as the limit because ordinary equipment will float down a 3 per cent. grade at the schedule speed, whereas, on a 5 per cent. grade the brakes have to be applied to keep the car within speed limits; but in this consideration other capital expenditures are involved—for instance, the distance of the grade from the power house will have an influence on the amount of copper feeders required in order to maintain the proper potential delivery. If the heavier grade is the maximum grade on the route, it might be necessary to increase the capital outlay in the power station to meet this demand, and this is especially true if the meeting points are at the top of the grade and the maximum demand for both equipments occur at the same time. This would increase the station outlay at least $90.00 per horse power, and it would also increase the station operating costs; moreover, most of the interest and maintenance on the additional power station equipment would be a standing loss, for this outfit would be required only for 41 seconds every 15 minutes.

The question involved in these cases is how much it is possible to reduce grades by forming an equation, one side of which is the cost involved in the reduction of the grade and the annual charge for this cost, the other side of the equation being the saving effected in power, time and maintenance. For each particular case the rate of interest for the cost of greater reduction can be equated against the operating expense in surmounting the proposed grade as against the reduced grade. The same argument applies with respect to avoiding curves. The saving in car mileage on a tangent track as compared with a track taking a sinuous course to reach the same terminals can be easily computed. In making the computation, regard should also be paid to the matter of slower schedules and increased accident hazard when operating on curves.

It will be seen that the interurban pays a heavy price for disregarding gradients and yet we find a large number of important systems operating over very heavy grades. The Eastern Ohio Traction Company, for example, has on its main line a grade of 2,700 feet, with a rise of from 10 to 12½ per cent. The Cincinnati, Georgetown & Portsmouth Railway Company has a grade of 8 per cent. for almost an equal distance, while the Philadelphia and West Chester Traction Company operates over maximum gradients exceeding 7 per cent.

In every case these companies have overcome the difficulty of heavy grades by the purchase of cars fitted with unusually high power motors, and by the expenditure of large sums for the provision of heavy feed wires and station equipment. In other words they have overcome the deterring effect of the law of gravity by the provision of unusual and enormous power which will drive the cars up the grades in spite of the resistance with which they meet. This, however, involves an expense which with a road of lighter grades could be avoided and therefore adds to the cost of operation without increasing the income. With the growing realization of the perpetual value of low-grade construction, no matter what the power employed, the tendency has been to construct interurbans with minimum grades. It is realized that where sufficient traffic is in sight to warrant the expenditure it is better to operate on low grades with high speed and less cost of operation than over heavy grades with less interest on capital but heavier power consumption and slower schedules.

Practically all of the interurbans built in recent years are located upon private rights of way. There are two methods of locating a line upon a private right of way. The road can either

parallel the highway, occupying a separately fenced-in roadway immediately adjacent thereto, or it can follow the practice of the steam railroads which consider the natural formation of the country rather than the location of the highways in the region. If the first method is followed, the company only partially escapes the limitations and handicaps which are met with by building its line upon the public road, for not only is it impossible in most cases to get property owners to forego their right to cross over the right of way to the public road, but it is likely that as time progresses and adjacent territory is built up, the number of these road crossings secured by the local authorities of the townships will increase. By this construction the interurban can decrease the number of cross-overs but cannot avoid them altogether. The property owner who has the right to come out on the highway at any and all points when the road was constructed in the public thoroughfare can be limited to use one or two cross-overs, but he will not voluntarily forego this privilege and he cannot be forced to do so. Such a location, therefore, minimizes but does not eradicate the evils of public road operation. It fixes with absolute precision the spots at which accidents are likely to occur, but it does not prevent such casualties.

The high speed suburban lines, of which there is a large number, it is true prefer a location parallel to the highway because the most thickly settled districts are contiguous to the main roads. The typical interurban companies, however, do not pursue this policy. They prefer a line constructed in the location which the engineers find most favorable from the standpoint of grades. They avoid rather than seek the highways, because by so doing they can cut down to the minimum, or entirely eliminate grade crossings. Such crossings as they encounter will be public roads located wide distances apart where the railroad company can protect itself by whistling as do the steam roads. Under such conditions the burden of care falls upon the persons who use the public highways rather than upon the railroad company. With cross-overs every 500 or 1,000 feet it is true the company might also maintain a policy of whistling at every crossing, but this would create a bedlam which would be intolerable both to the residents along the line and to the travelers on the car. As a consequence of the failure to whistle, however, the company shares with the traveler the necessity of exercising caution, with

the result that in damage cases juries find in favor of the plaintiff.

We may therefore conclude that the modern interurban railroad in its chief engineering characteristics differs but little from the steam lines. It is built on a private right of way with as few road crossings as possible. The stops are reduced to as small a number as is practicable, while the grades are kept down to the lowest point warranted by the volume of business considered in relation to the cost of construction. This is done both for the purpose of increasing the speed and in order to cut down the power consumption. All of these matters are of importance in the passenger travel, but if the interurban desires to handle freight they are of even greater moment.

The economic basis for the success of the interurban as a transportation agency for the handling of passenger business is easily understood. The ability to carry a large amount of power within a small compass and with a low percentage of dead weight, the economy of power generation, the ability to operate cars in single units with efficiency and profit, the possibility of surmounting grades which are insuperable to the steam locomotive, the absence of smoke, cinders and dirt, the ability to enter the very heart of the large city over the ordinary street railway tracks, bringing the rural traffic into the metropolitan business district without a change of cars over a roadbed whose cost is but a fraction of that of the steam line, all have given the interurban road such an advantage that its success as a transportation agency is assured.

The interurban secures its business from two sources, in the first place it immediately attracts to itself a large volume of traffic which had formerly been handled by the steam roads, bringing about at first, at least, a heavy temporary decrease in business upon the older lines. The latter have usually taken aggressive measures to prevent the loss of their business, both by reducing fares and by offering quicker and more frequent service. In most cases, however, their efforts have been fruitless. It is practically impossible to secure statistics which show the effect of the interurbans on the steam lines. The only accurate evidence upon this matter so far published is that showing the results of the competition of an electric line between Cleveland and Oberlin, Ohio, a town about thirty-five miles west of this city, and the

Lake Shore and Michigan Southern Railway. The steam railroad in 1895 carried 203,014 between these points; seven years later, after the fast interurban service had been established between these two cities, the number of Lake Shore passengers had fallen to 91,761, a decrease of from 16,918 to 7,640 passengers a month.

Similar results have occurred in all parts of the country. The interurbans have, in most cases, cut heavily into the short distance passenger travel of the steam roads, the lure of the frequent service and low fares usually being irresistible.

A large part of the prosperity of the interurbans has been due to the large amount of new traffic they have created. Travel is largely a matter of habit and by diminishing the effort required to travel, by taking on a passenger practically at his own door and transporting him quickly and comfortably in attractive, comfortable cars, without the smoke, dirt and noise incident to railroad travel, almost to the very door of his destination, the interurbans have greatly stimulated the travel habit, not only to their own profit, but to the infinite advantage of the thousands of farmers located along their lines.

While the steam railroads have suffered from the competition which the interurbans brought into their short distance work, they have probably more than recovered the loss in the large increase of long distance passenger business, which has resulted from the rapid growth of the traveling habit, for which the interurbans are largely responsible. Many of the best informed railway officials in the country predict that the time is not far off when the steam roads will be very glad to hand over to some other agency of transportation all of their short distance passenger work. They point out that in ordinary times the railroad facilities are always inadequate to meet the demands of the shipping public. Cars can be easily and comparatively quickly secured, but the duplication of roadway facilities is a serious matter, becoming constantly more difficult with the closer settlement of the country and the consequent growth in land values. The limitations upon the expansion of the traffic of our railroads are, therefore, furnished by the trackage and terminal facilities which they possess. It is contended that the railroads will soon be brought to the point where it will be a question of selection between various classes of business. Passenger work is the least

profitable and since the short distance business is actively sought for by other means of transportation, it seems likely that this will be the class of business which will be surrendered. Mr. Samuel Rea, third vice-president of the Pennsylvania Railroad, in testifying before the Royal Commission on London Traffic, 1906, stated that he did not think the trunk lines in the neighborhood of large cities could handle local traffic to advantage. He used as an illustration the suburban business outside of Philadelphia. He stated that the Pennsylvania Railroad Company's average rate for commuting riders out of Philadelphia is 7/10 of 1 cent. per mile, so that for five miles the company only gets 3½ cents, whereas the average cost of putting passengers through the Broad Street Station terminal is figured by the company at 3 cents. This leaves only one-half of 1 cent to pay for the transportation of the passenger. He believes that the greater use of the large terminals by the through business makes the short distance work relatively less profitable with each passing year. This view is generally shared by the railway officials throughout the country.

The feeling that the short distance passenger business occupies trackage which would produce larger earnings if they were devoted to freight, is bringing the steam lines constantly closer to the point where they are willing to turn over the strictly short distance work to the interurbans. The officials of the electric lines fully realize the protection which this situation gives them and they view with no feeling of uneasiness, the consequences of the electrification of the steam roads. They are confident that the interurban has come to stay, that its traffic is absolutely assured and is free from the possibilities of serious reductions.

Up to the present time the interurbans have only developed the traffic for distances ranging from ten to fifty miles. This has been due largely to the fact that the length of the average system is somewhere between these limits. During the last few years there has been a decided movement looking toward the consolidation of the smaller lines into a few large systems. As a result of this movement, together with the growing disposition among interurban officials to coöperate for their mutual advantage, numerous efforts have been made to offer a passenger service, intended to attract business for distances between fifty and one hundred miles. Considerable progress has already been made.

Several roads have in operation parlor, sleeping and dining cars, offering high-speed service between widely separated centers.

The economic basis of the long distance travel lies in the greater profitableness which is involved in the handling of a car of people for a long journey with few stops and at a relatively higher rate of fare. Under ordinary conditions a car has a heavy load for a short distance after leaving the city. In many cases standing room is at a premium. Cars are frequently overloaded and the extra weight and the frequent stops disarranges the schedule and demoralizes the system. For the greater part of the journey, however, the car is nearly empty. Such a traffic yields a heavy income in the first fare zone with a constantly decreasing income in each succeeding zone. The total earnings of a car for a trip would be smaller than had it been able to run loaded to one-half or one-third of its capacity throughout the entire distance.

Under ordinary conditions the development of long distance traffic is practically impossible. The existence of a defective and inadequate roadbed and equipment on a portion of the journey makes the whole ride unattractive. The comparative shortness of each road necessitates frequent change of cars, while the failure to closely adhere to schedules results in frequent missed connections and consequent vexatious delays. It is practically impossible to develop any considerable long distance business so long as it is necessary to change cars. A considerable through business can only be developed where special facilities are provided.

Two methods are generally employed in offering through service. The first is the coupling of a through car to the local car, running the two of them as a train. The through car is detached at the end of each road and is attached to the local on the next system. This plan, however, is feasible only where there is a strong similarity between the equipment on the various systems. Not only must they be sufficiently alike to permit of the cars of the various roads being coupled together, but it is necessary that they be equipped with multiple unit controllers, enabling several cars to be operated by a single motorman. Such a close similarity of conditions is very infrequent. Moreover, the officers of interurban roads object strenously to allowing their cars to be handled by men employed by other systems who they feel have been de-

fectively trained, and disapprove of allowing even ordinary repairs to be made in the shops of other companies whose employees are unfamiliar with their type of equipment.

In a number of cases, however, through cars or trains have been provided running over the entire route without change. Under this plan the earnings are apportioned among the several companies in a manner similar to that followed by the steam railroads. Owing to the fact that a number of cars can be operated at high speed with much greater power economy than single units, the tendency has been to operate the through service in trains of two or three cars. This system of operation has the additional advantage of being more popular with the people who have become accustomed to a service providing baggage and smoking cars and one or two day coaches. They expect similar conveniences of the interurban for long distance travel. Where the lines are sufficiently well built and equipped to make this possible, it seems likely that this plan will be more used. The development of long distance travel, however, is in its infancy. There is sufficient evidence to show that the most modern type of roads can offer it with advantage and with profit. The Lake Shore Electric Railway, for example, inaugurated some years ago a through service between Cleveland and Toledo, a distance of 118 miles. The competition which they had to meet was probably as severe as that which would be encountered by the interurbans in any section of the country. Not only does the line closely parallel the Lake Shore and Michigan Southern Railway, admittedly one of the best equipped and most efficient trunk lines in the country, giving frequent and high-speed service over a route which is nearly ten miles shorter than that of the electric road, but during eight months in the year there are steamers between these two cities, offering a pleasant trip and a lower fare than either of the other carriers could name. The express trains on the steam road make the trip in two hours and thirty-five minutes, while the ordinary train requires three hours and thirty minutes. The fare on the steam roads is $3.25. The schedule of the electric line is six hours for the regular cars, and four hours and thirty minutes for the limited cars which leave the terminal three times daily, morning, noon and evening. The fare on the electric line is $1.75, no matter whether the regular or limited cars are used. During the first month of operation

(January, 1903) 498 single trips were sold, while during the last month of that year 1,161 tickets were disposed of. Detailed statistics showing the operation of the line in later years are not available, but it has been stated that the traffic has steadily increased through the succeeding period. In November, 1903, the limited cars earned on an average of thirty-five cents per car mile, while the general average of the system for all cars was only twenty-two cents per car mile. The increase of earnings for the limited cars over the general average amounts to fifty-seven per cent. On a number of runs the earnings have exceeded one dollar per car mile.

While it is very difficult to secure accurate figures on the cost of maintaining the limited cars, yet sufficient data is available to enable the operating officials to state that they were less expensive to operate than the regular cars. The extra wear from high speed operation is more than offset by the saving in power required where frequent stops prevail.

The experience of the Cleveland line has been duplicated in numerous other sections of the country. It must be borne in mind, however, that long distance through traffic is only possible where the roads have been built according to the most approved technical standards with private rights of way, with low grades and easy curves, and where the entire distance between the terminal cities is under the control of one company, or where there is a sufficient spirit of coöperation to make possible joint operation under practicable conditions.

The rapid growth in the traffic of the interurbans has been largely the result of effective advertising and publicity work. The electric roads have gone much further than the steam roads in working out plans for increasing travel. The greater importance of this class of traffic to the interurban and the restricted area of the field in which the publicity work is to be done, are probably the reasons which explain the prominence of the newer transportation agency in this field.

The most generally used method of publicity is the posting of time cards in railway stations, hotel lobbies and other public places, and the placing of small racks containing printed schedules at these points. In addition to this a large number of interurban roads run regular cards in the newspapers announcing the time of arrival and departure of their cars. This advertising has in

almost every case proved to be very profitable. A considerable proportion of the interurban's riders are made up of traveling men who find it much more satisfactory than either driving or the steam railroads in making the various towns on their trips. The insertion of these schedules induces a drummer to use the interurban because he can figure out with certainty his day's itinerary before starting out from his hotel in the morning. The few extra fares which these cards and newspaper insertions will attract are practically all profit for the handling of this extra business adds but little to the cost of operation. A moderate number of additional fares, therefore, pays for the advertising matter many times over.

The most notably successful advertising campaign so far conducted is that carried on by the Twin City Rapid Transit Company of Minneapolis, Minn. Mr. A. W. Warnock, the general passenger agent, in a paper read before the Street and Interurban Railway Association at its 1907 convention, describes in detail the plans which have been followed. The company is fortunate in being located in the famous lake district of Minnesota and of having on its lines beautiful and picturesque scenery, providing many trips of general interest. It also operates the noted Big Island Park located on Lake Minnetonka. Mr. Warnock states that his company owes a large part of its success to the cultivation of cordial relations with the local newspapers. This good will is valuable not only in securing fair treatment in all controversies affecting the company, but is particularly advantageous in developing the excursion traffic. They have always followed the policy of making liberal use of newspaper space and have found it profitable. In addition to this they got out a nicely prepared folder, describing in an interesting way the many trips which can be taken on the Twin City Lines. Through the newspapers they attracted inquiries for this pamphlet and were able to get out many thousands of copies, not only to the citizens of the Twin Cities, but to hundreds of prospective visitors living in nearly every state in the Union. This folder was also to be had for the asking at the various ticket offices of the company and in the lobbies of the large hotels. This was followed by many other folders, attractively gotten up and nicely printed, describing special features and short side trips. In addition to this the company has made liberal use of car window cards, very

similar to the ordinary advertisements inserted in the street car. These were very cleverly gotten up and ran in a series very similar to some of the famous advertisements which have been put out by the breakfast food companies. The railway stations along the lines have been liberally filled with high-grade photographs showing the scenery along the various lines of the company. These prove of invariable interest to the traveling public and are believed to greatly stimulate business. The Twin City Company has found its advertising work to be immensely profitable.

In judging of the profitableness of advertising work, it is almost impossible to arrive at definite conclusions. However, by watching the increase in the volume of travel on particular lines, following the advertisement of special features, the railway manager can tell whether his efforts have been successful. The general experience of interurban men establishes beyond question the fact that intelligent and catchy advertising is of great value, particularly where the line has scenic features or points of interest which can be used to stimulate business.

This success of the interurbans in building up freight traffic has also been aided by the indifference of the steam roads to the class of shipments which the electric line gladly takes. It is well known that the steam railroads seek car-load freight rather than the smaller shipments. It has been estimated by traffic experts that over 85 per cent. of the total traffic of the American railroads is made up of shipments of car-load lots. They desire car-load freight for the following reasons: (1) car-load freight is loaded by the shipper and unloaded by the consignee, thereby relieving the railroad company of the responsibility of loss and the liability of damage and the cost of handling freight; (2) a very large percentage of the car-load shipments is handled both inbound and outbound on private sidings and in private terminals; (3) less bookkeeping and accounting, in proportion to the earnings, is required for car-load shipments; (4) the cost per ton mile to move ordinary commodities in car-load shipments is much less than to move a car of merchandise or package freight which must be handled at higher speeds and which requires large amounts of shifting and handling in the classification yards and transfer sheds. This apathy of the steam railroads towards broken shipments, which is expressed in the discriminations which are made against

it in the freight classifications, gives to the interurbans their opportunity to successfully invade this field.

The most important consideration in determining the profitableness of freight traffic is the cost of handling it. This determines the degree to which the interurban can compete with the steam road. The only reliable data which has yet been published upon this question is that contained in the address of H. H. Polk, president of the Interurban Railway Company of Des Moines, Iowa, before the American Street and Interurban Railway Association at its last annual convention. Mr. Polk addressed letters to the general managers of thirty of the most prominent electric railroads, requesting information upon the cost of handling freight. He found that the greater majority of them did not keep separate records of handling freight and passengers and therefore could not give him the desired information. From his own road, however, which is one of the most modern interurbans in the country, and has developed to a very high degree the handling of heavy freight, he compiled statistics showing the possibilities of interurban freight traffic.

The energy consumption of modern electric locomotives as determined by the tests of the General Electric Company, are as follows:

ENERGY CONSUMPTION

FREIGHT TRAINS

Gross Weight in Tons.	Schedule speed of trains	Watt hours per ton-mile at locomotive
100	15 m. p. h.	28
200	15 m. p. h.	23
300	15 m. p. h.	20
400	15 m. p. h.	19
500	15 m. p. h.	19

It will be seen that the energy consumption decreases as the train load increases, due largely to the reduction in wind pressure per ton in the longer trains. The cost of repairs and maintenance of a 40-ton locomotive equipped with 100 H. P. motors, while hauling a 200-ton train about 100 miles per day, will average 1.5 cents per locomotive mile. This sum includes not only the repairs to the motors and control, but also the care of the locomotive.

With this data as a starting point, Mr. Polk calculates that upon his system he can haul freight in train loads equalling the

maximum capacity of his locomotives at a cost of 0.02194 cents per ton mile. This figure includes the cost of power, the repairs to the locomotive, the cost of supplies used in the operation and the wages of the men operating the freight train. To this should be added, of course, a proportionate share of the fixed charges upon the line, a proportion of the expenses of track renewals, supervision, freight car repairs, expenses in freight stations and the many other items properly chargeable against this business. The steam railroads have never been able to mathematically calculate these expenses for each train or ton of traffic and the electric roads have not been more successful.

The experience of the Des Moines Interurban Railway shows, however, that it is possible to haul freight upon an electric road at very low costs. The electric road, if properly built, can handle heavy freight economically and expeditiously. The interurban, however, has not yet reached a stage of development where it can handle freight over long distances as cheaply as the steam lines. Even the best of the interurban lines are woefully deficient from a topographic standpoint as compared with the railroads. A basis of equality could not be reached until the electric lines possessed as low grades as the steam roads and this is neither likely nor desirable for the interurban in attempting to secure this evenness of grade would be forced to throw away a large portion of the advantages which it now possesses and which count so heavily in its favor. It is unlikely, therefore, that the interurban in the near future will become a serious rival of the steam lines for long distance freight traffic.

There are certain classes of heavy traffic which the interurban road can usually secure, for example, the live stock business. By putting in small stockyards, side tracks and loading shutes wherever they will be used the interurban secures many advantages over the steam line. If the shipment must be made by the latter, the stock must usually be driven from five or ten miles to some shipping point. The experience of shippers shows that the average shrinkage of driving cattle 12 miles is 47 pounds per head, while after entering the cars they may be shipped from 300 to 400 miles with a loss of 27 pounds per head. By using the electric railroad the shippers are often able to avoid the entire loss resulting from driving, which in the aggregate amounts to a large sum. The stock raiser will naturally prefer the electric line

even though it may not offer him the lowest rate, because the extra freight is more than offset in the selling price of his cattle in the city markets. The electric line also can offer other indirect advantages to the farmer. He can use the electric line to ship in coal, fertilizer, lumber, and all of the other heavy freight which he buys, and because of the shorter distance from the sidings to his barn he will be able to unload the car more quickly and with a smaller expenditure for labor and a smaller consumption of the time of his teams. In the same way a farmer contemplating a shipment of wheat, often threshed in the field, can notify the interurban of the time at which he will have his consignment ready, and can haul the grain from the thresher or grainery in much quicker time and with smaller expense for cartage than in case he had selected a steam road.

Many interurban roads have materially increased their freight earnings by encouraging the development of new crops along their lines. The management impresses upon the farmer, by a campaign of education, the profits to be derived from a new crop and secures the planting of a considerable area. It then encourages buyers to go into the district, and through the careful attention which it gives to these matters secures the whole crop for shipment over its line. This business is becoming a prominent and constantly growing source of income. A number of interurbans have gone so far as to build lines into districts underlaid with coal and to actively encourage and assist the opening of mines by distributing their product in the neighboring cities over the city lines. The interurban is rapidly pushing into every class of freight traffic, actively competing for it, and securing it more generally by the convenience and promptness which it offers than by the cutting of rates. Its field, however, as Mr. Polk picturesquely describes it, is that of a collector and originator of traffic, for " the steam roads are the main arteries of the commerce of the world, while the electric railroads are the capillaries that bring life and activity to the various communities."

The determination of the profitableness of heavy freight work to the interurban road depends not only upon the actual earnings derived from this traffic, but also upon the effect which its carriage has upon the operation of the rest of the system. A large number of companies have found, that owing to insufficient overhead work and generating equipment in the power house, the

handling of heavy freight by an electric locomotive plays havoc with their time schedule The drain of the electric locomotive reduces the voltage over the entire system and causes the passenger cars to run behind their schedule. A number of companies found, moreover, that their heavy-grades result in such a high consumption of power in handling cars as to make the service of the freight train very slow, causing congestion and delays in their passenger work. Others have found that their light roadbeds, often accompanied with steep grades have not been able to stand the severe usage which the handling of heavy trains inflicted. The consequent damage and deterioration often more than offsets the earnings which the freight traffic produces. The well built roads, however, having ample power and a roadway built in accordance with steam railroad standards, have been able to overcome these difficulties, and by the liberal provision of side tracks have been able to handle their freight business without interfering with or retarding the movement of passenger cars.

In judging of the profitableness of freight traffic it is necessary to take into consideration many factors, some of which often seem to be but remotely involved. The Ohio River Electric Railway and Power Company, for example, finds that freight business is both directly and indirectly profitable. They do a large electric lighting business in addition to their regular work, which makes necessary the continuous operation of their power houses all night. The interurban service is largely reduced after the early hours of the evening and disappears entirely after midnight. The engines in the power house, however, are still being run to generate current for light. By handling the freight during the night, when the railway power load is either very small or has entirely disappeared, the additional work makes up the full load of the power house, decreasing the cost of power, both for lighting purposes and for use on the interurban line. It is unfortunate that a large number of the interurban roads in the East are debarred by the difference in their track gauge from the direct interchange of car load freight with the steam railroads. The standard steam railroad gauge is four feet eight and one-half inches, while the standard street railway gauge is five feet two inches. In the Eastern states the street railway gauge has been used extensively by the interurban lines. This has in many cases been voluntary, being

the result of following current street railway practices, while in other cases it has been made necessary by legislation compelling the use of this gauge by roads using the public highways. Upon such lines the economical handling of car-load freight is practically impossible.

The extent to which the well equipped interurbans can develop car-load freight traffic depends largely upon their ability to secure satisfactory traffic agreements with the steam railroads. Many railroad companies endeavor to strangle the electric lines by either refusing to coöperate or by cutting rates for the purpose of driving the interurban out of the freight business. The sections in which they must meet competition bear such a small percentage to the total mileage of their system that they can afford to carry heavy losses in this restricted area in order to destroy the competition of the interurban. Many of the Western States have passed laws intended to prevent these tactics. The State of Iowa, for example, has a law providing that if a railroad company shall reduce its rates to low levels in certain localities where interurban competition is encountered, the same rates for similar classes of traffic shall automatically take effect throughout the state. The steam railroad, therefore, which inaugurates a policy of rate cutting in Iowa to injure an interurban is brought face to face with the adoption of the low charges over the entire system. The law has effectually put an end to such practices in that state.

A large number of interurban roads have been admitted to membership in the local freight associations in their district, prorating on the usual basis with the steam railroads on all traffic. Many other roads have never been formally admitted into the older companies' traffic associations, but interchange traffic with some or all of the roads in the territory, receiving a compensation on a tonnage basis in proportion to the number of miles hauled over their lines. In most cases, however, the interurban road is unable to make money out of handling car load freight under ordinary working agreements based upon mileage rates. A number of them have secured concessions from the steam railroads allowing them a larger percentage of the earnings than they would ordinarily receive upon a mileage basis. Many interurban roads have found themselves in an embarrassing position as the result of a percentage agreement entered into with the steam line. When the latter cut rates, the earnings of the interurban roads were re-

duced to an unprofitable level. In many cases, however, the steam lines have been far-sighted enough to protect their weaker associates from the consequences of this unfortunate situation. They have either voluntarily released the electric lines from the percentage agreement, or have made up the deficiency in some other way.

The most progressive steam railroads are coming to realize that the interurban is not a true competitor even in handling carload freight. It is a branch line or feeder constructed with outside capital and operated without worry or trouble to the trunk line: a branch which collects freight and turns it over to the main system for transportation to the far distant market. The interurban takes the place of the branch line which is profitable to the steam railroad only because it delivers traffic for long hauls and is itself usually unprofitable. The interurban is also more profitable to the large railway system than a branch line, because it can more effectively develop traffic. The interurban is essentially a local affair. It operates within a restricted territory and can more fully realize the traffic possibilities of a section than the large organization of the steam railroad. The relatively insignificant amount which the railroad loses by dividing its local business with the interurban is offset many times by the extra tonnage which is developed in this section.

The interurban railroads have also made material progress in developing an express business. This traffic is either handled in conjunction with one of the large express companies doing business all over the country, or separately and independently by the interurban or a subsidiary corporation organized in its behalf. The Cincinnati, Dayton and Toledo Traction Company, for example, handled its express traffic through a subsidiary corporation whose stock is owned by the interurban road. The traction company furnishes the cars, crew and power and receives ten cents per mile for the mileage of the freight cars. The express company attends to the collection and delivery of the freight and handles all the work incident thereto. It owns thirty wagons and teams in the leading towns along the line and has established stations at almost every stop. Each wagon has a regular route and makes four trips a day, picking up and distributing express matter. The company employs a number of solicitors whose duty it is to encourage country merchants to

direct that goods which they order from jobbing or city merchants shall be shipped by the interurban. The gross receipts of the express company during 1904 amounted to between $3,000 and $4,000 a month, of which 75 per cent., it is calculated, is eaten up in operating expenses. Even on this basis, however, the traction company derives a good profit from this feature of its business. The Lake Shore Electric Railway has also developed a considerable express business through its subsidiary organization, the Electric Package Company. This company started out to do a freight business, but found that the handling of light packages at high rates was more profitable. They, therefore, organized a package company and gradually withdrew from handling heavy freight. In 1904 the road cleared over $17,000 net from this source.

The greatest difficulty which the interurban encounters in developing its express traffic is the large amount of expense which must be incurred in collecting packages. This is particularly necessary because the central station in most of the large towns is not as advantageously located as those of the express companies doing business over the steam lines. If, however, a sufficient volume of business can be secured to warrant the employment of this expensive means of collection, the traffic is profitable. Recent investigations show that in the Middle West companies are about equally divided between freight and express business. The differentiation between these two classes of traffic consists more in the name than in the fact. The larger majority of roads handling light freight, and they are the greater proportion of those doing a freight business, in reality are handling traffic which would be shipped by express if the steam railroads were relied upon. The distinction, therefore, is clearly one of terminology, of the speed of service and of the rates which are charged. The lines handling light freight usually charge rates which are higher than the ordinary freight rates for the same classes of articles and which are lower than the rates given by the large express companies for the same service. By charging a rate between these two extremes the interurban is able to capture a large amount of this business.

Many roads which handle both freight and express traffic differentiate between them, largely upon the basis of the speed of delivery. Express matter is hurried through with all profitable

despatch, being sent on the first car departing after the arrival of the goods. The freight traffic, however, is allowed to accumulate and is shipped at the convenience of the interurban road. When a car has an insufficient amount of express matter to fill the compartment the empty space is filled with freight. When, however, a full load of express is at hand no freight is shipped. The freight, therefore, acts as a feeder to the express business, constituting practically the same sort of traffic which the regular steamship lines except at cut rates in order to make up their cargo. The interurban can well afford to handle such business at low rates, for practically all the earnings which it produces is profit. This plan has been followed with success by the Western Ohio Traction Company and by the Appleyard System.

The interurban roads are still passing through the experimental stage with both light freight and express traffic. Many of them are charging rates which are higher than are demanded by the cost of operation and which, however, do not produce the maximum amount of revenue from this source. By excluding a large amount of farm products they decrease their volume of traffic and consequently cut down their earnings. A number of roads have experimented over long periods with different rates, in order to ascertain the charges which will prove the most desirable, both to the shipper and the railroad. The great variety of local conditions which are met with and the peculiar circumstances surrounding each property make any general rule or basis of charges impracticable and require that each manager shall by observation and experiment work out his own problems.

The electric interurban is as yet in its infancy. The twenty years of its life have been more momentuous than that of any period of equal length in the history of transportation and it is likely that the next two decades will be equally as revolutionary. The future of the interurban railroad is most promising. A realization of the economies of constructing these lines upon the most improved engineering standards has removed most of the causes for the failure of these enterprises in the past.

An even more significant trend in interurban development is toward a general realization that every step in advance should be prompted by a traffic motive, and that every improvement which is made should increase the ability of the company to

secure and develop business and to more effectively compete with the steam road.

The future of the interurban contains boundless possibilities. Its development has just begun, and the first principles which will guide its progress have been established. In view of the wonderful changes which occurred in the past, it is difficult to accurately forecast the future in store for these roads. Certain tendencies, however, are so plainly apparent as to indicate the general nature of the future history of these properties. The rapid progress which has been made in the last few years in consolidating many small roads into a few large systems, indicates that the interurban is going through the same development which marked the history of the steam roads fifty years ago. There is little doubt that a large majority of the present interurban companies will be consolidated into a few large systems, although it is unlikely that the new companies will reach the magnitude of the large steam railroad companies. There is no economic basis for an electric interurban system covering ten to fifteen states. These consolidations will bring with them a marked elevation in the technical standards of the interurban roads. The practices of the most progressive roads will become the standards of all, and the standardization of cars, equipment, roadbed and machinery will make possible the development of long distance business, and the more general exploitation of freight possibilities. This movement will be checked to a serious extent by the mistakes which were made during the early years. The existence of lines poorly constructed, and operating over almost prohibitive grades is a serious obstacle to any general and rapid advance, for the reconstruction of these properties on modern lines would increase the fixed charges of the companies to a prohibitive point. The future of such roads is dismal. It is in the first place, unlikely that the consolidation will include these companies. If they operate between centers originating large traffic, their position is extremely perilous, for it is probable that some powerful company will build a low grade, high speed line connecting the two cities and take away practically all of the traffic which the older company had depended upon. This has already occurred to a considerable extent all over the country. One of the most recent examples being between Boston and Worcester, Massachusetts.

The interurban line is likely to continue to be preëminently a

passenger carrier. The importance of the freight business, however, will relatively increase, although it is not likely that these roads will ever seriously compete for the heavy long distance freight work. It is unlikely that the interurban will generally fall under the domination of the steam roads, for the people of the sections which are involved, realizing the advantages of the regulative influences which the interurban exerts, will prevent their absorption by the steam railroads. Effective legislation toward this end has already been enacted in many states.